

Application No. 10/737,272

AMENDMENT TO THE CLAIMS

Please replace the currently pending claims with the following amended claims:

1. (Currently Amended) An electrical circuit interconnect element comprising:
an anchor portion coupled to a substrate in a substrate plane;
a release portion including a first end coupled to the anchor portion, the release portion ~~including at least one in-plane curve, the release portion further including a lift line where an uplift portion of the release portion begins~~ a first curve that curves to curve out of the plane of the substrate, the first curve in a plane approximately perpendicular to the lift line, the release portion further including a second curve wherein the second curve is not in the plane approximately perpendicular to the lift line;
and,
a curved spring tip coupled to a second end of the release portion, and wherein the direction of maximal curvature of the curved spring tip lies in a the plane approximately perpendicular to the lift line.
2. (Currently Amended) The electrical circuit interconnect element of claim 1 wherein the release portion is released from the substrate such that an internal stress gradient in the uplift portion causes the uplift portion to curve out of the plane of the substrate.
3. (Currently Amended) The electrical circuit interconnect element of claim 1 wherein the uplift portion includes a plurality of in-plane curves not in the plane approximately perpendicular to the lift line, said plurality of curves in the uplift portion subtends an angle that totals approximately zero degrees.
4. (Currently Amended) The electrical interconnect element of claim 1 wherein the release portion is formed from one of molybdenum, tungsten, chromium, zirconium or nickel, or their alloys.

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5. (Currently Amended) The electrical interconnect element of claim 1 wherein the anchor portions of the electrical interconnect is coupled to an integrated circuit.

6. (Currently Amended) The electrical interconnect element of claim 1 wherein the length of the uplift portion is less than 5mm.

7. (Currently Amended) The electrical interconnect element of claim 1 wherein the release portion further comprises:
an unlifted portion.

8. (Currently Amended) The electrical interconnect element of claim 7 wherein the unlifted portion is prevented from uplifting during processing by a photoresist overhang.

9. (Currently Amended) The electrical interconnect element of claim 1 wherein the release portion includes an aperture, the largest dimension of said aperture exceeding half the median width of the release portion.

10. (Currently Amended) The electrical interconnect element of claim 9 wherein the largest dimension of said aperture exceeds the median width of the release portion.

11. (Currently Amended) The electrical interconnect element of claim 9 wherein the aperture includes a plurality of flexible support structures on either side of the aperture, the flexible support structures curved in the plane of the substrate prior to release of the uplift portion.

12. (Currently Amended) The electrical interconnect element of claim 1 wherein the spring tip is cut straight across, the spring tip remaining within 10 degrees of a plane parallel to the substrate plane.

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13. (Currently Amended) The electrical interconnect element of claim 1 wherein the release portion includes a plurality of small openings to facilitate etching of a release layer.

14. (Currently Amended) The electrical interconnect element of claim 1 wherein the release portion is plated to increase stiffness.

15. (Currently Amended) An electrical interconnect element comprising:
an anchor portion coupled to a substrate; and,
a flexible stressed metal forming a release portion, first end of the release portion coupled to the anchor portion, the release portion including at least one in-plane curved section wherein the in-plane curved section is in a plane approximately parallel to a surface of the substrate, the release portion also including an uplift portion ~~such that the total of angles subtended by all curves in the uplift portion is approximately zero degrees; and,~~
a curved spring tip coupled to a second end of the release portion, wherein the direction of maximal curvature of the curved spring tip lies in a plane approximately perpendicular to the lift line.

16. (Currently Amended) The electrical interconnect element of claim 15 wherein the uplift portion includes no curves that are not in a plane approximately perpendicular to a lift line.

17. (Currently Amended) The electrical interconnect element of claim 15 wherein the release portion further comprises a planar portion.

18. (Currently Amended) The electrical interconnect element of claim 17 wherein the planar portion is prevented from uplifting during processing by a photoresist overhang.

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19. (Currently Amended) The electrical interconnect element of claim 15 wherein the in-plane curves are on either side of an aperture in the release portion.

20. (Currently Amended) The electrical interconnect element of claim 19 wherein the largest dimension of the aperture is over 50% of the median width of the release portion.

21. (Currently Amended) The electrical interconnect element of claim 19 wherein the width of the aperture exceeds the median width of the release portion.

22. (Currently Amended) The electrical interconnect element of claim 15 wherein the release portion includes a lift line, a direction of maximum curvature at a curved tip of the release portion oriented approximately perpendicular to the release line.

23. (Currently Amended) The electrical interconnect element of claim 17 wherein the length of the uplift portion is between 0.1 micrometer and 5 mm and the width is between 0.02 micrometer and 1 mm.

24. (Currently Amended) The electrical interconnect element of claim 15 wherein the release portion is plated with a material to improve conductivity.

25. (Currently Amended) The electrical interconnect element of claim 20 further comprising:

a first flexible supports on a first side of the aperture, the first flexible support having a width less than 49% of the average width of the spring; and,

a second flexible support on a second side of the aperture, the second flexible support having a width less than 49% of the average width of the spring.

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26. (Currently Amended) An electrical interconnect element comprising:
an anchor portion anchored to a substrate in a substrate plane; and,
a stressed metal spring including a stress gradient that includes a compressive stress in lower spring layers and a tensile stress in upper spring layers coupled to the anchor portion, the spring including an aperture in the spring, the entire perimeter of the aperture bounded by spring material, the largest dimension of the aperture exceeding 50% of the width of the spring, and,
a tip coupled to an end of the stressed metal spring and oriented by the stress gradient such that the direction of maximal curvature at the spring tip points in a direction that is non-parallel to the substrate plane.

27. (Currently Amended) The electrical interconnect element of claim 26 wherein the width of the aperture is at least 0.05 micrometer.

28. (Currently Amended) The electrical interconnect element of claim 26 wherein the width of the aperture exceeds the average width of the spring.

29. (Currently Amended) The electrical interconnect element of claim 26 further comprising:

a first flexible supports on a first side of the aperture, the first flexible support having a width less than 49% of the average width of the spring; and,

a second flexible support on a second side of the aperture, the second flexible support having a width less than 49% of the average width of the spring.

Claims 30-32 (Cancelled)

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33. (Currently Amended) An electrical circuit interconnect element comprising:
an anchor portion coupled to a substrate in a substrate plane;
a release portion including a first end coupled to the anchor portion, the release portion including at least a first one in-plane curve and a second in-plane curve, the first in-plane curve curving in a different direction than the second in-plane curve, both the first in-plane curve and the second wherein the in-plane curve is in curves in a plane approximately parallel to the substrate plane, the release portion further including a lift line where an uplift portion of the release portion begins to curve out of the plane of the substrate; and,
a spring tip coupled to a second end of the release portion, and wherein the direction of maximal curvature at the spring tip lies in a plane approximately perpendicular to the lift line.

34. (New) The electrical circuit interconnect element of claim 1 wherein the second curve curves away from the anchor portion.

35. (New) The electrical circuit interconnect element of claim 1 wherein the second curve is in a plane that is substantially parallel to the substrate plane, the second curve to substantially enhance a lateral compliance of the electrical circuit interconnect.

36. (New) The electrical circuit element of claim 1 wherein the second curve second curve is in a plane substantially parallel to the substrate plane and wherein the second curve includes a curve segment that curves away from the anchor portion.

37. (New) The electrical circuit interconnect element of claim 1 wherein the release portion further includes a third curve wherein the third curve is not in the plane approximately perpendicular to the lift line and is curved in a different direction then said second curve.

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38. (New) The electrical circuit interconnect of claim 37 wherein the second curve and the third curve are in a plane that is substantially parallel to the substrate plane.

39. (New) The electrical circuit interconnect of claim 1 wherein the release portion is formed from a stressed metal spring material including a stress gradient that includes a compressive stress in lower spring layers and a tensile stress in upper spring layers